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WOOD ANATOMY OF THE NEOTROPICAL SAPOTACEAE. I. 'BUMELIA'.(U)
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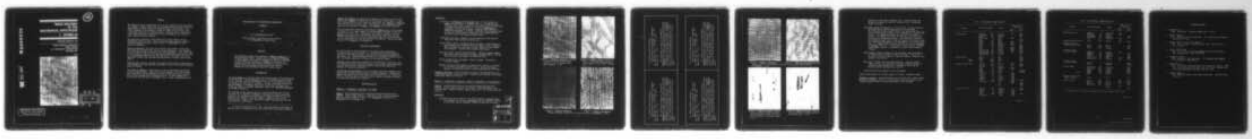

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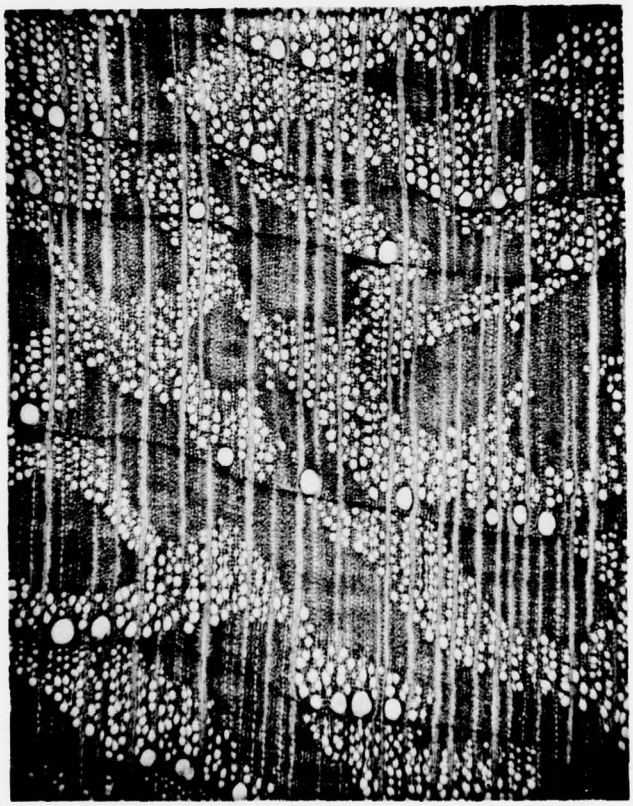
I. BUMELIA

RESEARCH PAPER FPL 325

FOREST PRODUCTS LABORATORY
FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE
MADISON, WIS.

1978



Preface

The Sapotaceae form an important part of the ecosystem in the neotropics; for example, limited inventories in the Amazon Basin indicate that this family makes up about 25% of the standing timber volume there. This would represent an astronomical volume of timber but at present only a very small fraction is being utilized. Obviously better information would help utilization--especially if that information can result in clear identification of species.

The Sapotaceae represent a well-marked and natural family but the homogeneous nature of their floral characters makes generic identification extremely difficult. This in turn is responsible for the extensive synonomy.

Baehni and Bernardi (3) state the situation with respect to Peru but this would hold equally well for all of the neotropics: "For instance, of the 39 species and one variety described hereunder, 13 are known only from the Peruvian type; and 23 taxa here presented have no fruit or seed. It is universally admitted that the taxonomy of this family is almost impossible without--for the same species--leaves, flowers, fruits, and seeds."

Unfortunately, species continue to be named on the basis of flowering or fruiting material alone and this continues to add to the already confused state of affairs.

This paper on Bumelia is the first of a series describing the anatomy of the secondary xylem. Publication in this manner will afford interested anatomists and taxonomists the time to make known their opinions and all such information is hereby solicited. At the termination of this series the data will be assembled into a single comprehensive unit.

WOOD ANATOMY OF THE NEOTROPICAL SAPOTACEAE

I. BUMELIA

By

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Forest Products Laboratory, Forest Service
U.S. Department of Agriculture

Abstract

Two anatomical groups are recognized in Bumelia; Bumelia A is characterized by small, angular pores and tracheids arranged in flame-shaped tracts and the presence of spiral thickenings in the vessels and tracheids; in Bumelia B the pores are rounded in outline and arranged in radial or echelon tracts and the axial parenchyma has scattered cells that are completely filled with microcrystals (crystal sand).

Introduction

The genus Bumelia is the most widely distributed genus of the Sapotaceae in the Americas. The northernmost limit is in Central Missouri, about 39° N. latitude, and the southernmost limit is in Corrientes Province of Argentina at about 30° S. latitude. In habit the genus varies from small decumbent or ascending shrubs and small trees to large trees producing timber of economic importance, such as B. obtusifolia excelsa of northern Argentina.

The taxonomy of the species native to the United States was covered by Clark (4) in which he recognized 14 species and several varieties. Cronquist (5) recognized 23 species and a number of varieties in the Americas but reduced to five the number of species native to the United States. Eight of his species are known from type only or from less than five collections.

1/ Pioneering Research Unit, FPL. The Laboratory is maintained at Madison, Wis. in cooperation with the University of Wisconsin, Madison.

Bumelia and Dipholis are generally recognized as distinct taxa but were united under Bumelia by Baehni (2) in his survey of the family. In the most recent treatise on the family by Aubréville (1), Bumelia and Dipholis were considered as distinct taxa. The anatomy of the secondary xylem supports the separation of Bumelia and Dipholis as distinct entities.

The last published anatomical description of Bumelia was a brief account by Record (7) of a small number of wood specimens available in the Yale Collection at that time. Taxonomists have made no attempt to divide Bumelia into sections but the present description takes into account the fact that there are two basic anatomical types and the differences are of a magnitude that warrant separate descriptions. These are simply referred to as Bumelia A and Bumelia B.

Materials and Methods

For this study 73 wood specimens were examined which represented 11 species and varieties (table 1). Microscope slides were prepared from all of the wood specimens using the new techniques developed by the author (6). These techniques resulted in successful slides on wood that was almost impossible to handle by conventional means.

Although a few slides were available in the Laboratory collection, they were eliminated from contention because it was evident that hydrofluoric acid had been used for softening and this effectively removed all evidence of crystalline material.

Terminology and measurements are in accordance with the standards developed by the International Association of Wood Anatomists. Photomicrographs were made with a Zeiss camera utilizing Polaroid 4 X 5 Land film type 55. Specific gravity values cited are based on weight and volume at a moisture content of 6-7 percent.

Wood Description

Bumelia A. (lanuginosa, lycioides, and tenax)

General: Wood yellowish with no distinction between heartwood and sapwood. Growth rings distinct. Wood hard, heavy, and fine-textured. Specific gravity range of 0.54 to 0.85 (lanuginosa average 0.73; lycioides 0.74; and tenax 0.76).

Anatomical:

Arc-porous in lanuginosa and lycioides (fig. 1) but variable in tenax from arc-porous to diffuse (fig. 2). Earlywood pores solitary and in short uniseriate arcs; mostly oval and attaining a maximum tangential diameter of 118 μm in lanuginosa and lycioides; up to 80 μm in tenax. Latewood pores angular in outline and embedded in vascular tracheids, which together form distinctive flame-shaped or dendritic tracts emanating from the short arcs of the large earlywood pores.

Parenchyma reticulate, diffuse, and also forming closely spaced uniseriate lines between the wood rays.

Vessel members short, averaging 350 μm in length. Inter-vessel or more commonly the vessel-tracheid pit pairs 6-8 μm in diameter. Spirals present to a greater or lesser degree in the vessels and tracheids. Tyloses, when present, thin-walled.

Wood rays (1)2-4 seriate, heterocellular. Vertical fusions common. The normal rays (unfused) attaining a maximum height of 375 μm. Vessel-ray pitting irregular in shape and size.

Fibers thick-walled; averaging 1.24 mm in length. Vasicentric tracheids common.

Rhombic crystals, microcrystals (crystal sand), and silica lacking in the axial parenchyma and wood rays. Pale brown organic deposits occasionally present in the parenchyma and wood rays.

Diagnostic features: Wood yellowish; arc-porous, the latewood pores in flame-shaped tracts; spirals present in vessels and tracheids; and without crystalline deposits or silica.

Bumelia B. (celastrina, glomerata, obovata, obtusifolia, and persimilis)

General: Wood yellowish with no distinction between heartwood and sapwood. Growth rings indistinct or lacking. Wood hard, heavy, and fine-textured. Specific gravity ranges from 0.75 to 1.07 with an average of 0.87.

Anatomical:

Diffuse-porous; pores round or oval and attaining a maximum tangential diameter of 142 μm in persimilis but not exceeding 110 μm in the other species examined. Pores solitary and in radial

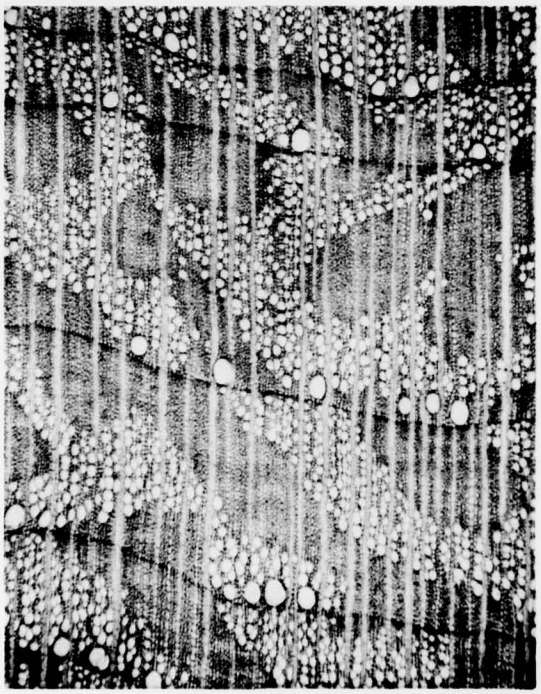

Figure 1.--Bumelia lanuginosa, showing arc-porous condition and flame-shaped tracts of latewood pores and tracheids. X 30.

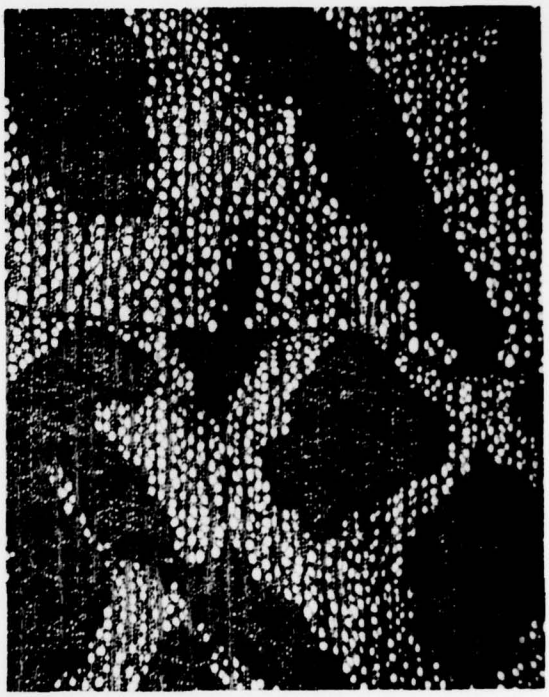

Figure 2.--Bumelia tenax, similar to figure 1 but with earlywood pores only slightly larger than latewood. X 30.

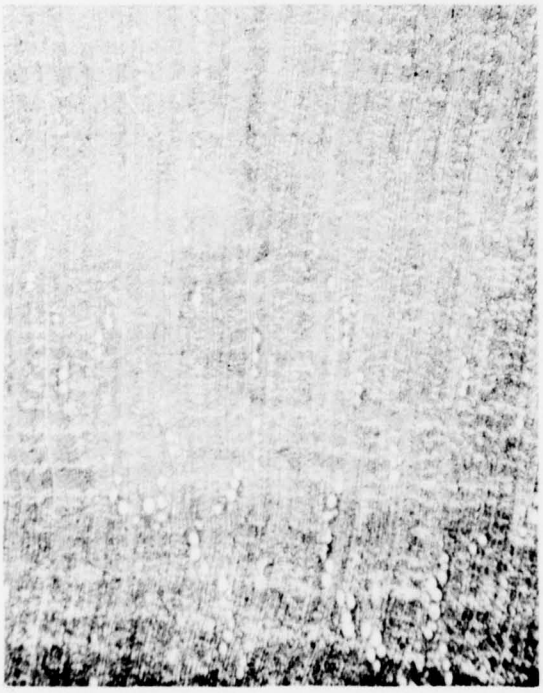

Figure 3.--Bumelia glomerata. Compare extremes of pore size in radial-echelon arrangement. X 30.

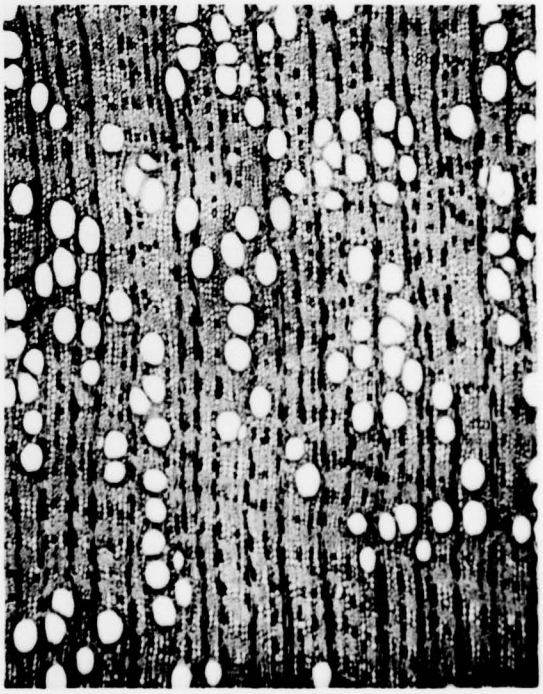

Figure 4.--Bumelia panamensis.

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Wood anatomy of neotropical Sapotaceae: I. Bumelia, by B. F. Kukachka. Res. Pap. FPL 325, For. Serv., U.S. Dep. Agr., Madison, Wis. 9 p.

Two anatomical groups are recognized: Bumelia A has small, angular pores and tracheids arranged in flower-shaped tracts and with spiral thickenings in vessels and tracheids. Bumelia B has rounded pores arranged in radial or echelon tracts. Axial parenchyma has scattered cells completely filled with microcrystals (crystal sand).

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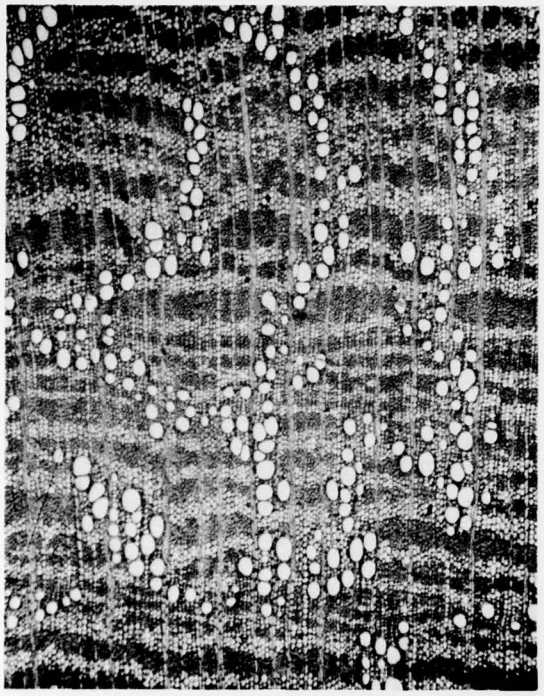

Figure 5.--Bumelia celastrina. Compare pores of intermediate size and in clustered radial-echelon arrangement. X 30.

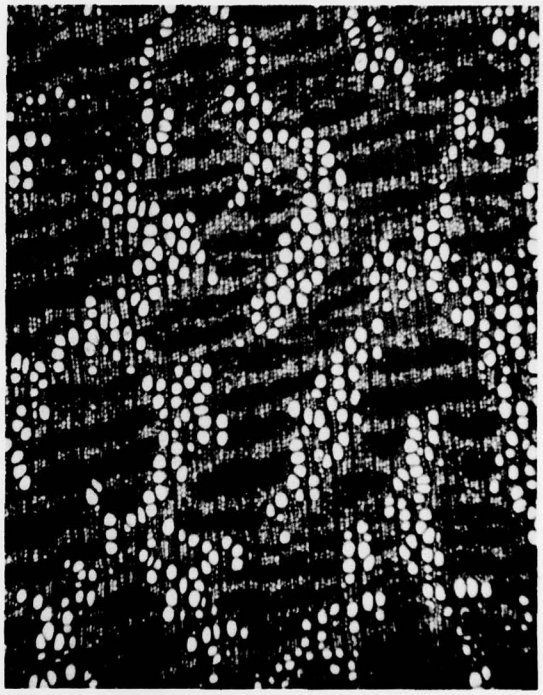

Figure 6.--Bumelia obtusifolia excelsa.

Figure 7.--Bumelia obovata, showing normal crystal strands and three axial parenchyma cells filled with micro-crystals. Polarized light. X 275.

Figure 8.--Bumelia obovata, showing two strands of two-sized crystals. Polarized light. X 275.

multiples to five (most commonly 2-3). Solitary pores and multiples arranged in radial or echelon files or groupings (figs. 3,4,5,6).

Parenchyma banded and generally 3 to 5 seriate. In some instances the bands may be loosely aggregated or discontinuous. Microcrystals always present in the axial parenchyma (fig. 7); cells containing the crystals few to abundant in a given radial section. In comparing freshly cut sections with finished slides it is evident that many of these may be "washed" away during the slide-making procedure. The individual crystals are extremely small (up to 2 μm) and consist of calcium oxalate. The crystalline aggregates are birefringent in polarized light (fig. 7). Rhombic and two-sized crystals present in glomerata and obovata (fig. 8). In two-sized crystals usually a single, large rhombic crystal is embedded in a mass of much smaller crystals.

Vessel-member length averages for all specimens range from 350 μm to 560 μm with an overall average of 456 μm. Inter-vessel pit-pairs 4-6 μm in diameter. Spirals lacking. Tyloses, when present, thin walled.

Wood rays (1)2-4(5) seriate; heterocellular. Vertical fusions common; normal rays (unfused) attaining a maximum height of 670 μm but most commonly with a maximum of about 500 μm. Without crystalline deposits or silica.

Vessel-ray pitting irregular in size and shape.

Fibers thick-walled; an average length of 1.38 mm. Tracheids common.

Diagnostic features: Wood yellowish; pores solitary and in short radial multiples arranged in radial or echelon files; spirals lacking; microcrystals always present in axial parenchyma; silica lacking.

Table 1.--Wood specimens of Bumelia examined

Species	Collector and number		Origin	Numbers in wood collection	
				MADw	SJRw*
celastrina H.B.K.	Caldwell	8783	Florida	4122	49310
	Curran-Haman	534	Venezuela		2827
	Dugand	231	Colombia		22520
	Field Museum	sn	U.S.	24964	
	Mell	3	Mexico		6981
	Nogle	330	Texas		42538
	Ortega	52	Mexico	32856	1211
	Pittier	4988	Panama	5817	
	Record	123	Guatemala	32878	10074
	Scott	sn	Florida		36371
	Stern	85	Florida	16879	49428
	Stern	117	Florida	32860	49443
	Stern-Brizicky	293	Florida	18245	51123
	Stern-Brizicky	322	Florida	18251	51146
	Stern-Brizicky	355	Florida		51171
	Stern-Brizicky	452	Florida		51235
glomerata Griseb.	Bucher	sn	Cuba		16137
	Bucher	66	Cuba		16239
(stem)	Acuna	16467	Cuba		40732
(root)	Acuna	16467	Cuba		40733
lanuginosa (Michx.) Pers.	Beilmann	8507	Missouri	9432	49049
	Bur. For.	1615	U.S.	32872	11840
	Detweiler	48	Arizona		14773
	King	sn	Oklahoma	20027	
	Nogle	234	Texas	13220	
	Palmer	sn	Texas		22801(H)
	Palmer	33973	Texas		20996(H)
	Phil. Expo.	4	U.S.	2864	
	Sackett	sn	U.S.	2957	
	Stearns	521	Texas	9646	
	Sudworth	1	Arizona	2955	
	Sudworth	2	Arizona	2956	
	Tharp	8269	Texas	8981	49048
	10th Census	139	U.S.	20444	
			U.S.	32861	6695
			U.S.		21841
			U.S.		11842
lycioides (L.) Pers.	Anderson	94	Florida		45883
	Bur. For.	1616	Tennessee	32876	11843
	Harper	1	Georgia	2968	
	Koehler	108	Missouri	2948	
	Nogle	2600	Texas	13264	47416
	Nogle-Wilson	8	Texas	15586	

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Table 1.--Wood specimens of Bumelia examined--con.

Species	Collector and number		Origin	Numbers in wood collection	
				MADw	SJRw*
obovata (Lam.) A. DC.	Commercial	sn	Puerto Rico	3594	
	Commercial	141	Venezuela	3615	
	Curran-Haman	158	Curacao		2137
	Curran-Haman	410	Venezuela		2785
	Miller	1631	Puerto Rico	20858	
obtusifolia Roem. and Schult.	Little	6612	Ecuador	10427	40978
Obtusifolia buxifolia (Roem. and Schult.) Miq.	Curran	524	Curacao		2820
	Judd	3620	Hawaii		37272
	Pittier	12432	Venezuela		11067
obtusifolia excelsa (A. DC.) Cronquist	Commercial	sn	Paraguay	1025	
	Commercial	109	Argentina		6253
	Commercial	1619	Argentina		3974
	Curran	378	Argentina		1044
	Forest Service	33	Brazil	13106	36098
	Forest Service	313	Argentina	12164	23539
obtusifolia excelsa (A. DC.) Cronquist	Noverras	9	Argentina		14966
	Venturi	1	Argentina		22802(H)
persimilis Hemsl.	Austin Smith	4163	Costa Rica		38379
	Austin Smith	4229	Costa Rica		38440
	Dugand	508	Colombia		27080
	Dugand	823	Colombia		29653
(root)	Dugand	849	Colombia		29679
	Kluge	12	Panama		7126
persimilis subsessiliflora (Hemsl.) Cronquist	Ortega	sn	Mexico		10387
tenax (L.) Willd.	Bur. For.	1614	U.S.	32877	11844
	Rhoads	8397	Florida	9356	49050
	Smith, H. H.	74889	Georgia	32859	26936
	10th Census	178	Florida		5181
			U.S.	2967	
			Florida		6694

* Specimen numbers in the right column marked (H) are from the Harvard Wood Collection.

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